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ABDUL RAHMAN K. AL GHUNAIM

The key to international economic development is the development of modern, efficient telecommunications systems in developing countries, the author argues

Telecommunications—the view from Kuwait

TODAY WE are in an age of information. The growth and exchange of information taking place in the course of a year nowadays, perhaps, exceeds all the exchanges that took place since the dawn of civilization. An intelligent world suddenly finds itself articulate. The resulting floodwaters of knowledge have to be guided carefully into productive channels, if people are to be protected from their otherwise destructive potential. At the same time, areas that are insulated from the flow of information can dry up and turn into inhospitable desert, if they are not also brought under the streams of scientific thought and technological progress.

Contagious

In the spread of technological benefits, several international organizations have done commendable work. Chief among them is ITU (International Telecommunication Union).

The ITU is noted for distinguished service in the field of telecommunications for over 100 years.

In the recent past, ITU has generated a commendable amount of activity in the field of technology transfer. In addition to organization global and regional plans for telecommunications development, ITU has arranged tutorial handbooks and publications specially designed to aid the developing countries. The regional plan for the Middle East and Mediterranean development is a thorough treatment of a subject requiring wide-ranging coordination. Similar plans for other developing areas of the world and provision of experts and advisers for implementation are the other important contribution of ITU for telecommunications development. On the subject of rural telecommunications, ITU organized a series of seminars successively in 1972, 1974 and most recently in Sept. 1978. The resulting collection of ideas has contributed greatly to advance the cause of worldwide telecommunications development.

The world is becoming increasingly aware of its responsibility to the developing countries. In 1975, the United Nations General Assembly resolved to promote the activity of international cooperation for the betterment of less developed countries and called upon international agencies to assist in this process.

The United Nations (UN) Economic and Social Council also adopted similar resolutions and the International Bank of Reconstruction and Development rendered the required assistance. The problems of technology transfer for the benefit of the developing countries also were discussed in a series of seminars conducted by the UN Conference on Science and Technology for Development.

This would not be a new process or a new direction because the tradition of international cooperation and assistance, especially for the developing countries of the world, has been well established.

Kuwait's experiences

Here are some of the experiences which we had in developing telecommunications in Kuwait. For those in charge of a vast telecommunications organization, extend-

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ing its jurisdiction over a large territory, the problems of a small state with almost unlimited resources, may not appear to be representative. But our experiences are unique in the sense that in about 20 years we will attempt to embrace the developments of a century. We have indeed come a long way from the early days of 1960 when we had a few thousand telephones, to the present time, when we have almost every sophistication known to the telecommunication industry. Before this era of development, Kuwait had few resources and the people were engaged in trade and fishing. Today, the society is transformed. Apart from oil, industrial output and trade in machinery form a significant part of Kuwait's revenues. The banking and other financial institutions also are well developed. The significant change that has taken place in Kuwait's economy can be seen in Table 1.

Originally confined to the walled city adjoining the Shuwaikh Port, the built up area of Kuwait has extended progressively. In the plans ahead, two new townships are contemplated, one in the Northern zone and one in the South. In the intervening areas, new townships are springing up almost every year.

The telecommunication services have been sufficiently well developed to cope with the demands arising from such unprecedented development. Table 2 illustrates the correlation between (non-oil) trade and telecommunications services.

The variations in telecom traffic precede the corresponding changes in trade figures. The deviations from the expected increases in telephone calls in 1976 and 1978 show the extent to which the services are sensitive to the absence of, or provision of, adequate facilities to carry the traffic. It also is interesting to note that telephone and telex traffic complement each other in times of abnormal difficulty in either of them.

A fundamental need

Looking back over the conditions in Kuwait 20 years ago, one finds an answer for many of the questions raised in international forums concerning telecommunication development. Over all these years, it has been assumed that the developing countries, especially their rural areas, have nothing to communicate. But experience has proved this wrong. To the Kuwaiti tradesmen, 20 years ago, the advantages of telecommunication contact with the outside world were clearly understood.

Today in Kuwait, telecommunication facilities are sought eagerly by every segment of the society. Kuwaities of all ranks, as well as expatriates, demand telephone connections. In areas developed for settling the nomadic Bedouins, a telephone connection is as much in demand as in the center of the city.

The demand for mobile telephones in cars has picked up inspite of a comparatively high price and although, in the small state, fixed telephone terminals are available everywhere with no call charges.

If proof is needed for the hidden demand for telecommunications in any society, the example of Kuwait should be adequate.

As one who has witnessed the transformation of a miniature society from rural to urban, from the uneducated to educated, from the nomadic to a highly motivated metropolitan society with all modem facilities and as one who has witnessed the consequent changes brought about in the life and mores of the people, I can say that this transformation through improved telecommunications is not impossible to achieve all over the world; nor does it cost so much that the world community, as a whole, cannot afford it in the course of a few years.

It should, therefore, be understood that telecommunication development is a fundamental need and has to be given higher priority by governments over the development of the other elements of infrastructure, like roads, and over the other social services like health, hygiene and education.

The only controlling element in the scope for telecommunication development is economic. How much can a society afford and how much does the facility cost? But more important is the spur to economic growth provided by telecommunications. The reason why telecommunication development has been confined to the centers of affluence in the world, and therefore to the cities, is that it has been considered a service which has to pay for itself. Initially, therefore, it was in the hands of private companies with a profit motive. Even when it was passed on to the governments, the concept that it should be self supporting has continued to exist up to this day. No wonder, therefore, that the telephone density has become synonymous with GNP (gross national product), and vast areas of the globe remain isolated and neglected with not even one telephone for miles.

And yet people must communi-

Continued on page 92

Year	Manufacturing Industries	Wholesale and Retail Trade	Transport and Communication	Finance & Insurance Real Estate	Total
71/72	42.0	90.0	41.0	21.0	194.0
75/76	163.7	189.6	84.7	151.1	589.1

TABLE 1 *Gross national product by industrial origin (millions KD).*

cate. Today it is well understood that, like water and food supply, telecommunication facilities stand high on the list of priorities for any society, rural or urban.

It has been said of another important Middle Eastern country that it could easily have become the commercial headquarters of the Middle East, if only the telecommunication facilities there were up-to-date and modern. No trade or banking operations, no operations on shares and stocks and no improvements in educational and health facilities are possible in a country with poor telecommunications. The people have to be in touch with each other constantly and with the utmost efficiency possible.

Erosion though migration

The world's population is expanding at an explosive rate and the mass migration from the rural to the urban areas are creating unimaginable problems for the social planners. The living space in the urban areas gets congested, creating cesspools of polluted air, while the rural societies lose all their charms by this erosion. If this undesirable trend is to be halted and reversed, better telecommunications in rural areas is essential. It also is the cheapest of the several alternatives available.

The telecommunication facilities have advanced so greatly and have such immense possibility that, if they are well planned and installed, it is immaterial whether a person lives in the center of a city or a few hundred miles away. Teledata, video text, fascimile services, electronic mail, teleconferencing facilities as well as developments in the handling of television services for education and health purposes, can and will make one's own location on this planet immaterial. Anyone can be in touch with any type of society anywhere in the world, through modem telecommunications. This way the vast countryside can be opened up for human beings to live and the world can gain much additional living space.

The rural areas

The case for urgent development of rural telecommunications is well recognized. Any responsible society must ensure a uniform spread of facilities. The principle of parity between rural and urban sectors indicates that at least a minimum level of service should be provided for the rural communities. For the development of the rural society, education and health are important.

For these to be provided rapidly, telecommunication facilities must have first priority. Apart from the link with the outside world the telephone provides to the teacher or the medical assistant, it also helps them professionally to derive the maximum benefit from a central educational institution or from a nearby hospital. The telephone or telegraph breaks the sense of isolation for a population and gives the security that only a developed society can provide. Administrators can have greater control over the area. Law and order can be effectively maintained. Warning of impending natural disasters like floods can be conveyed at short notice.

The village can more easily arrange social and cultural functions through telecommunications and thus make life richer for its inhabitants. Timely information on specific activities in marketing, agricultural or veterinary operations can be had.

Thus, telecommunications is necessary not only for the industrial and business efficiency of the developed urban sectors, but also in the interests of social stability and developments in the comparatively weaker sections of the rural sector.

With the addition of facsimile equipment to the voice circuit, handling of record messages becomes routine and can be left to unskilled hands. The facsimile also can aid in quick transmission of records, finger prints and other pictorial information. These will be particularly useful in health and educational programs, as well as in issue of notices to the public. Rural banking can be developed by remote banking facilities. Business can develop through dial-ordering. Crop and general insurance can be effectively handled through effective data processing.

Given the combined will of the people and a few standardized facilities, the opportunities are unlimited.

Apart from the individual telephone terminals providing single party circuits with secrecy of communication, the terminal facilities to be provided should, therefore, include facsimile equipment capable of transmission as well as reception. The voice circuit also can be used for alarms, remote monitoring and data transmissions of various types with appropriate terminal equipment.

Optionally, depending on feasibility, a community center television terminal also can be arranged, provided a TV bearer channel can be extended to the nearest earth station or microwave terminal.

Strategy for development

Experience has shown the type of telecommunication equipment and organization that are best suited to the developing countries. The earlier concept that, because there is a large work force and a need for economy, the discarded technology of the developed countries could be exported to the developing ones, has been proved wrong. The technology best suited to a developed country assumes a well knit organization with a fairly uniform capability in different cadres. The developing country should do with a few capable people while a large number will be entrusted with routine simple activities.

The technology for development should provide for integrated development of all the communication needs of the society. In addition to telephone and telegraph facilities, television and broadcasting should be developed simultaneously. In choosing the terminal equipment, the end product of improved educational and medical assistance should be kept in mind.

The operations expected in the remote or rural areas should be simple and unsophisticated, while the central office in the nearby urban center can have the more complex equipment. The urban centers should be interlinked for overall organizational control and should each be the center of control for all

the neighboring areas.

Stability and reliability are important in rural communications, and because the network is so vast and connections so numerous, it is necessary to minimize the chance of systems malfunctioning. Instead of spending money on repair work, it is far better to invest in more reliable equipment initially. One corollary to this maxim would be that, wherever feasible, underground cables should be the main connecting links, rather than overhead wires.

The type of equipment that will be used should be suitable for areas exposed to extreme temperatures, dust and humidity. The construction should be robust and the design should be held fairly stable over a number of years in order to avoid frequent changes of equipment.

The system should have adequate self diagnostic and indication facilities for easy restoration in cases of faults.

The technique adopted should be capable of mass production and easy, rapid installation, if our goal of universal telecommunications is to be achieved in a short time.

And because the organizational base in developing countries cannot be expected to be strong, the telecommunication development and maintenance must be entrusted to regional boards, consisting of all the countries in a region.

A modem approach

These requirements point to a novel and modern approach very different from what has so far been adopted in the developing countries, where open wire lines with a manual or central battery terminal telephone has been the standard rural telecommunication facility. Morse telegraph equipment should be replaced by modern facsimile equipment, and digital techniques should be adopted to provide a number of telephone connections on a single pair of wires in a cable.

The key to rural communication development will be satellite communication, with small sized antennas. Whereas extensive installations of terrestrial systems are likely to be costly and time consuming, installation of earth stations at rural centers could be economical in both time and money. From each such rural center, communication can be extended to the neighboring villages by one or more of a few standardized arrangements, using radio equipment or coaxial or paired cables. Large scale integrated circuits on printed boards will be used resulting in reduced size of equipment and ease of maintenance. With the constraints as stated above, it is perhaps inevitable that the terminal device will be very different from the currently available equipment. They may use digital techniques and the necessary codec may be incorporated in them.

It is paradoxical that the appropriate technology for the developing countries in telecommunication equipment is the latest and most modern, not one in vogue a few years ago.

The advent of satellite communication in the '60s brought a new world order in international telecommunications. It broke down the difference between the cities of the developed and developing countries. The unfinished part of the revolution will be completed if satellite communications are used to bridge the gap between the different strata of the same society, the rich and the poor, the urban and the rural.

Cost of the scheme

Such a revolution is already under way and the experiences gained so far in Algeria, Sudan, India and Indonesia as well as the well-known Alaskan experiments have paved the way for a concerted drive by the international commu-

Continued on page 96

Year	Trade Import & Non-Oil Export		International Telephone Calls		International Telex Calls	
	Value KD	% Increase over previous Year	Minutes	% Increase over previous Year	Minutes	% Increase over previous Year
1971	266,690					
1972	311,773	16.8				
1973	380,505	22.0	2,060,434		717,077	
1974	572,269	50.0	3,207,060	55.7	1,129,030	57.5
1975	863,976	50.0	4,487,749	39.9	1,867,708	65.37
1976	1,187,628	37.5	4,861,879	8.0	2,985,344	59.8
1977	1,636,000	37.7	7,005,515	44.07	3,472,732	16.3
1978			13,085,754	86.7	4,505,175	29.7

TABLE 2 *The correlation between (non-oil) trade and telecommunications services.*

nity to complete the task of total rural telecommunication development.

The telecommunication network for the rural sectors of developing countries must follow a recognized pattern and should form part of the global network. The starting point of a rural network will therefore be a small town or a similar location which is already a part of the national microwave network of the country's terrestrial plan. Where such facilities are non-existent, the easier and the most economical means is to install a small diameter antenna for satellite communication.

A digital exchange associated with this terminal can cater to several branch routes with remote switching units (concentrators). The circuits to each branch will conform to a few selected choices in analog and digital techniques and the medium used may be freely chosen from several alternatives, the particular choice depending on the circumstances.

The broadband facilities, for which adequate technology already exists, are left out of the scope in order to keep the aims at an economical and practical level for rapid implementation. According to present day techniques, each local exchange can cater to an area of about 80 km radius utilizing PCM (pulse code modulation) systems and concentrators. From each concentrator overhead or underground lines can be extended to subscribers' sets. Where the number of subscribers is less, analog carrier system or narrow band VHF or UHF systems with multiple access facilities can be employed. The exchange also can provide service to a remote community through conventional radio circuits.

It also is possible to design the subscriber terminal with the necessary codec and timing circuits in order to multiplex several terminals over a common pair on a time division basis.

It has been estimated that 80% of the cost in rural telecommunications is in providing the external plant or the so called route costs. The common merit in all the above options is in reducing the per station route costs for the subscriber without reducing the quality. One other aim is to make the same circuit yield multiple uses as telephone, record and facsimile.

With the combined talent of the world, considerable economy can be achieved for an extensive coverage of the rural areas.

The community TV and the cable TV system also can be incorporated, wherever feasible, in the scheme.

The reason why the governments of the world are not embarking on a large scale rural telecommunication program is the relatively high cost and the meager anticipated return on investment. And yet telecommunication engineers, accustomed to engineering projects, are aware of the wide range in costs for various alternatives. And the first step in reducing costs is to make a start. We all are aware of the phenomenal decrease in costs of space segment provided by INTELSAT for international telephone communication. Starting with $32,000 in 1965 per half circuit per year it is now $5760, in spite of the depreciation in the dollar and in real value of money.

If the suggestion for standardization and mass production of equipment is followed on a global basis, there will be few areas where the scheme cannot be economically feasible. The large increase in the satellite circuits in the global network again illustrates the interacting effects of increasing growth and reducing costs.

The example of INTELSAT is noteworthy in another instance as well. This high technology device started exclusively with the most advanced countries of the world. But within a decade, the participation of the developing countries increased progressively, if not in the manufacture of the equipment, at least in the better utilization of the benefits. Whereas in 1971 the top eight countries (consisting of USA, UK, France, West Germany, Japan, Italy, Canada and Australia) controlled about 80% of satellite utilization, in 1979, their cumulative share came down to 57.3%. Because there is a great scope for developing countries to improve their telecommunications, this process is bound to continue. We can reasonably expect a similar situation where rural areas are concerned in relation to their more fortunate cities, once the rural telecommunication scheme gets under way.

We have mentioned that, in remote areas, communication by a domestic satellite or dedicated transponder should be seen as the feasible solution. The cost of the small diameter antenna has been generally reported to be around $50,000 to $100,000. But in 1975 when an experimental rural television program was conducted in India through ATS-6 Satellite, the antennas were prepared indigenously at $300 to $350. Reduction of costs for fixed antenna, constructed with compacted mud and cement plaster and lined with aluminum dish brought the figure to $150 each.

This is one reason why, in a program of this kind, there must be a plan for the manufacture of the maximum numbers of components in the developing countries, where the costs are low and the inflationary effects of advanced countries are not passed on to the developing ones.

A look at Table 3 will indicate the scale of expenditure, and how unrealistic is the talk of costs in the face of the much publicized global interests in assistance to developing countries. The countries are chosen at random, and it should not be constructed that they are specifically singled out for any special mention. They fall in to three categories. Section A consists of developed countries which are reaching saturation in telecommunication facilities and have consequently a lower rate of growth. Yet their investments in telecommunication projects run into thousands of millions of dollars. Sections B and C show the rate of growth in developing countries. Whereas B shows a comparatively high rate for a small investment, C has little hope of advancement due to paucity of funds.

And because telecommunication development is vital to the well being of the international community, it should be subsidized by the state and provided uniformly in a country. And if individual countries are unable to do it without

help, the world community should come forward to do it. A little help from the advanced countries of the world will go a long way to our cherished goal of global telecommunication development. Once started, telecommunication always pays its way both by direct and indirect returns.

Power supply for the remote terminals is another constraint to rural telecommunication development. From the dawn of the telecommunication industry, this problem has been faced by telecommunication engineers, who pioneered the modern revolution in areas where electricity had not penetrated. Thanks to the modern energy crisis, sufficient development has already taken place in unconventional power supply designs which are capable of unattended operation using readily available sources of energy. Development of solar energy techniques alone has produced a revolutionary change in the concept and design of networks, whose real potential will be realized only in years to come.

Fortunately in the recent times several hitherto neglected areas have come to demand increasing attention from the administrators and social planners. The developments in the Middle East point to the urgent need of improving conditions in the less privileged areas. The Arabsat is a venture designed primarily to bring about a social integration of urban and rural areas in all the countries of the Arab world. The trend in the Indian subcontinent also is for rapid development of the rural sectors. Consequently large allocations are being made for rural telecommunications in countries as far separated as in the Indian sub-continent, in the Middle East and in South America.

If the developing countries are called upon to purchase standardized equipment from the established manufacturers of the telecommunication industry and install them, we may be sure that their enthusiasm will be much less because of their lack of participation. It would be prudent, as well as pragmatic, to decentralize the efforts and secure the cooperation of all countries on a regional basis for design, manufacture and installation of the telecommunication network.

For the development to take place on any significant scale, the penetration of telecommunications in the rural sectors should be rapid. From the present number of less than one telephone for every 1000 population in the majority of the rural areas of developing countries, a target figure of at least one telephone for every 100 population (subject to a minimum of one for each village) should be achieved in 10 years. Here, it should be understood that the telephone will represent the integrated voice/record facility which was discussed earlier. Considering that in the Alaskan experiment every community of 25 people was provided with a satellite earth station, this target should be seen as a modest and feasible achievement. In areas of relative prosperity where telecommunications have already made headway, in towns and cities of developing countries a more significant target should be set.

The scale of installations and the appropriate costs of the scheme are easily calculated from the information already available. If these costs are too much for the industry to bear, the state should subsidize in the interests of national development. And because the world has a stake in the uniform development of telecommunications all over, the world community must take a hand in implementing these proposals.

These proposals are not new to the world community. All the requirements have been analyzed in many seminars all over the world.

	Country	Total No. of Telephones end 77	No. of Telephones Per 100 Population	Rate of Increase In One Year	Average Annual Investment Million $
A	Japan	49,697,000	42.6	6.4%	6746
	West Germany	22,900,000	34.4	8.0%	2023
	Italy	16,146,000	27.1	5.1%	1676
	Switzerland	4,140,000	63.8	2.6%	429
B	India	2,025,932	0.3	15.4%	305
	Korea	1,681,254	5.0	20.1%	439
	Kuwait	155,000	13.0	10.0%	52
C	Ethiopia	79,000	0.3		23
	Malawi	21,820	0.4		4
	Oman	19,000	0.5		8

TABLE 3 *The scale of expenditures for telecommunications in developed and undeveloped countries.*

And because there is a general desire to expand global telecommunications, I believe that the time has arrived to take decisive action.

I would like to stress that implementation is the key word in this process. What are the methods of achieving results expeditiously? One way is to allow ideas to germinate and actions to follow in their natural sequence. Judging from the economic conditions in the developing countries and the rate of "progress" achieved so far, this is a sure road to disaster. The other alternative is for a world body like ITU to take the initiative and form an organization for implementation, both on a global and regional level. Besides ensuring progress on an international level and benefiting the developing countries, the process will ensure an important role for ITU to play in this exciting task.

I suggest that a Telecommunication Development Council be formed consisting of ITU, INTELSAT, the World Bank or its subsidiaries, representatives of the design and manufacturing interests and representatives of developing countries to initiate action and follow progress.

This Council will form regional bodies to decentralize activity and ensure uniform and rapid development all over the world. The Regional boards, wherein all the telecommunication administrations of the region will be members, will work in close cooperation.

Joint ventures can be set up in the several regions of the world for mass production of the standardized telecommunication equipment, the joint venture involving the countries of the region and representatives of telecommunication manufacturing industries. The selected industries may be dispersed among the countries of the region to promote uniform development and to create a sense of interdependence for their total needs. The staff for the manufacturing industries, for installation and maintenance, could be drawn from the countries of the region on an equitable scale. Working together they will pave the way for better regional understanding and a capacity to work together.

These will allocate the priorities for setting up of industries among the constituent countries, determine their needs and resources available, assign priorities and execute the projects in such a manner that a uniform development is achieved among the countries of the region.

The World Administrative Radio Conference (WARC) has an onerous task in this area (see page 49). When frequencies are allocated, specific provisions must be made in each band for the spread of telecommunications facilities in the developing countries and for rural telecommunications in particular. I hope that the world body takes firm decisions along the lines I have suggested. □

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EVIEW & FORECAST '80 spending by U.S. telcos to top $20 billion; Top men see need to diversify (cover, p. 33)

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telephony
THE JOURNAL OF THE TELEPHONE INDUSTRY SINCE 1901

Telco construction spending to top $20 billion in '80

New decade begins with new high in planned expenditures, but it's not enough to keep up with inflation; top executives look ahead to the 'information system age'

Leo Anderson, Editor, and Gerry Barrett, Special Projects Director

Cover design by Leo Zayauskas

PREDICTIONS point to construction expenditures of more than $20 billion by the U.S. telephone industry in the first year of the new decade.

MOVING into the decade of the 1980s the U.S. telephone industry passes two significant milestones: (1) its projected construction expenditures for the first year of the new decade are well over $20 billion, a record high; and (2) total telephones in use reached 175 million.

The expected construction spending total for 1980 is $20,921,000,000, which will be $1,076,000,000 higher than the estimated 1979 total of $19,845,000,000. While telco spending is massive—and massively increased for 1980—it is not keeping pace with inflation. The projected increase over 1979 is 5.4%, while the consumer price index (CPI), the most common inflation yardstick, was advancing at an annual rate of 11.2% at year end.

Both the Bell and Independent segments of the telephone industry foresee record construction spending for the year, but the increases are at a lower rate than in the immediate past. The Bell System's $16,660,000,000 construction spending total for 1980 is 4.7% over 1979's $15.9 billion; that compares with a 14% increase in 1979 over 1978. On the Independent side, 1980 spending is expected to be $4,261,000,000, compared to $3,935,000,000 in 1979. That's an 8.3% increase, but in 1979 spending was increased 13.4% over 1978. (See Table 1 for details.)

American Telephone & Telegraph Co. (AT&T) provided information for these statistics, as well as the 22 largest Independent telephone companies. The large independents participating represent 87.9% of the gross plant investment of the total Independent segment. Further data were provided by the U.S. Independent Telephone Assn. (USITA), enabling TELEPHONY to provide totals covering the entire U.S. telephone industry.

Major executives of 13 top telephone systems and companies also commented on industry trends to add further depth to this survey article. Those statements covered such factors as the effect of the current economic downturn on the industry (expected to be mild), technological advancements and their effects, deregulation and increasing competition, the effects of inflation, the consumerism trend, usage sensitive pricing, inter-city pricing changes and their effects on local service pricing, increasing need for—and scarcity of—highly skilled employes, changes in distribution

Table 1 Independent and Bell Construction Expenditures

	Independent Telephone Companies (millions of dollars)**			Bell Telephone Companies (millions of dollars)***			Combined Independent & Bell Telephone Companies (millions of dollars)		
	Const. Spending	Increase (Decrease) vs. Previous Year	% Increase (Decrease)	Const. Spending	Increase (Decrease) vs. Previous Year	% Increase (Decrease)	Const. Spending	Increase (Decrease) vs. Previous Year	% Increase (Decrease)
1958	$ 488	$—	—	$2,241	$—	—	$2,729	$—	—
1959	507	19	3.9	2,297	56	2.5	2,804	75	2.7
1960	565	58	11.4	2,710	413	18.0	3,275	471	16.8
1961	566	1	—	2,759	49	1.8	3,325	50	1.5
1962	619	53	8.6	3,044	285	10.3	3,663	338	10.2
1963	677	58	9.4	3,204	160	5.3	3,881	218	6.0
1964	780	103	15.2	3,566	362	11.3	4,346	465	12.0
1965	928	148	19.0	3,960	394	11.0	4,888	542	12.5
1966	1,130	202	21.8	4,248	288	7.3	5,378	490	10.0
1967	1,254	124	11.0	4,359	111	2.6	5,613	235	4.4
1968	1,366	112	8.9	4,812	453	10.4	6,178	565	10.1
1969	1,560	194	14.2	5,820	1,008	20.9	7,380	1,202	19.5
1970	1,665	105	6.7	7,314	1,494	25.7	8,979	1,599	21.7
1971	1,953	288	17.3	7,728	414	5.7	9,681	702	7.8
1972	2,053	100	5.1	8,483	755	9.8	10,536	855	8.8
1973	2,325	272	13.2	9,516	1,033	10.9	11,841	1,305	12.4
1974	2,618	293	12.6	10,283	767	8.1	12,901	1,060	9.0
1975	2,422	(196)	(7.4)	9,525	(758)	(7.4)	11,947	(954)	(7.4)
1976	2,481	59	2.4	10,044	519	5.5	12,525	578	4.9
1977	2,797	316	12.7	11,793	1,749	17.4	14,590	2,065	16.5
1978	3,471	674	24.1	13,951	2,158	18.3	17,422	2,832	19.4
1979	3,935*	464*	13.4*	15,910*	1,959*	14*	19,845*	2,423*	13.9*
1980	4,261*	326*	8.3*	16,660*	750*	4.7*	20,921*	1,076*	5.4*

*Estimated
**Source: USITA
***Source: AT&T (Bell Telephone Companies include AT&T, its principal telephone subsidiaries, and Bell affiliates, Southern New England Telephone Co. and Cincinnati Bell, whose common stocks are minority-owned by AT&T.)

and ownership of terminal equipment, high interest costs, expected changes in communications law, and the increasing need for marketing orientation among telephone companies and the executives who run them.

Statements of the executives commenting on these trends appear as a series of mini-articles beginning on page 47. A view of long range industry trends was expressed by Alan C. Hasselwander, vice president of corporate planning & development at Rochester (N.Y.) Telephone Corp.:

"The shape of the telecommunications industry will change dramatically in the upcoming decades. A new industry may evolve from the fusing of telecommunications with data processing . . . Rapid changes in technology will require increasingly sophisticated skill levels on the part of engineers, technicians and managers. The capability of our human resources will be the most critical element to success in telecommunications."

Looking even further into the future, William J. Umphred, president of Commonwealth Telephone Co., Dallas, Pa., said: "As we look to the '80s and beyond, we must restructure our planning process and investment decision to accommodate the needs of the information system age. We must become responsive, marketing-oriented organizations. Those companies which have the courage to innovate and adapt to change will survive the communications explosion. Many will prosper from it. And some may well be blown away by it."

Commenting on the more immediate view was Robert P. Reuss, chairman of Central Telephone & Utilities Corp., Chicago, Ill.: "In looking at the challenges facing the industry during 1980, the protection of the integrated toll network must be considered a major objective . . . In addition, because of the thrust of competition, the prospect of deregulation and in anticipation of dramatic technological advances, our operations must become more market-oriented. We will have to plan strategically to meet rapid change . . ."

175 million phones

As the year began, total telephones in the U.S. were estimated at 175 million, of which 80.9% were Bell System phones and the rest Independent. The Bell System total was 141.6 million, an increase of 4.16 million over a year ago. The Independent segment's year-end '79 total was 33.4 million, up 1.8 million over '78. The Independents, thus, are growing at a faster rate than Bell, with Independent phones increasing 5.8% in 1979 over 1978, and Bell phones increasing 3% in the same period. This continues a trend of many years' standing.

USITA, which provides overall Independent statistics for this article, also estimates 1980 year-end totals. It estimates Independent telephones will increase another 1.7 million during the year to 35.1 million, a 5% gain.

Another major yardstick—investment in total telephone plant—increased by $9.8 billion in the Bell System, from $110.5 billion to $120.3 billion, for the 12 months ended Nov. 30 for both 1978 and 1979. Gross plant investment for Independents is estimated to increase to $34.6 billion in 1980, up $3.3 billion from $31.3 billion last year.

The Bell System operating com-

Continued on page 36

Table 2 Independent Telephone Company Statistics

Number of Telephones, United States (000 omitted)

	Year-End Total	Increase
1964	14,127	—
1968	18,125	3,998
1972	23,187	5,062
1973	24,782	1,595
1974	25,286	1,044
10-year Growth 11,699=82.8% of year-end '64		
1975	26,823	997
1976	28,209	1,386
1977	29,675	1,466
1978	31,549	1,874
1979	33,400*	1,851*
1980	35,100*	1,700*

Number of Independent Telephone Exchanges

	Year-End Total	Increase
1964	10,696	—
1968	10,889	193
1972	11,104	215
1973	11,106	2
1974	11,048	−58
10-year Growth 352=3.2% of year-end '64		
1975	11,057	9
1976	11,040	−17
1977	11,045	5
1978	11,053	8
1979	11,060*	7*
1980	11,070*	10*

*Estimated
Source: USITA

Number of Independent Telephone Companies

	Year-End Total	Decrease
1964	2,534	—
1968	1,970	564
1972	1,760	210
1973	1,697	63
1974	1,641	56
10-year Decrease 887=35% of year-end '64		
1975	1,618	23
1976	1,590	28
1977	1,556	34
1978	1,527	29
1979	1,500*	27*
1980	1,480*	20*

Investment in Gross Plant ($000,000 omitted)

	Year-End Total	Increase
1964	$ 6,103	—
1968	9,774	3,671
1972	15,555	5,781
1973	17,418	1,861
1974	19,600	2,182
10-year Growth $13,491=221.1% of year-end '64		
1975	21,200	1,600
1976	23,000	1,800
1977	25,130	2,130
1978	27,788	2,658
1979	31,315*	3,527*
1980	34,661*	3,346*

Total Operating Revenues ($000,000 omitted)

	Year-End Total	Increase
1964	$ 1,493	—
1968	2,261	760
1972	3,788	1,521
1973	4,316	528
1974	4,920	604
10-year Growth $3,421=229.5% of 1964 Revenues		
1975	5,500	580
1976	6,300	800
1977	7,115	815
1978	8,085	970
1979	9,237*	1,152*
1980	10,356*	1,119*

Employes

	Year-End Total	Increase
1964	100,766	—
1968	129,430	28,664
1972	155,000	25,570
1973	161,000	6,000
1974	163,000	2,000
10-year Growth 62,234=61.7% of year-end '64		
1975	158,000	−5,000
1976	160,000	2,000
1977	167,000	7,000
1978	179,000	12,000
1979	192,000*	13,000*
1980	200,000*	8,000*

*Estimated
Source: USITA

pany work force increased by 34,741 to 857,900 as of Nov. 30, 1979, which compares with 823,159 at the same date in 1978. This continues a three-year trend in the System. Previously—in 1974-76—Bell System employment experienced a downtrend. Independent segment employment continues a five-year trend of increases, with the number of employes expected to reach 200,000 in 1980, up 8000 over the 192,000 of last year.

Operating revenues for the Bell System rose to $45 billion in 1979 (12 months ended Nov. 30) compared to $41.9 billion the previous 12 months. USITA estimates the Independents' operating revenues will increase $1.1 billion, to $10.3 billion in 1980, compared to $9.2 billion in revenue last year.

The number of Independent telephone exchanges also is expected to rise by 10, to 11,070 in 1980, compared with 11,060 in '79. Continuing a small, steady decline, Bell System exchanges went down to 6703 in 1979, from 6705 in 1978.

Minus 20 telcos

While all other Independent statistics experience an uptrend, the number of individual Independent telephone companies continues to decline. USITA estimates that mergers and acquisitions will result in the disappearance as separate entities of 20 telcos during 1980. Total Independent telcos, thus, will drop to 1480 from the 1979

Continued on page 38

Table 3 Bell System Statistics*

Number of Telephones (000 omitted)**

	Year-End Total	Increase
1968	91,122	—
1969	95,943	4,821
1970	99,903	3,960
1971	103,699	3,796
1972	108,811	5,112
1973	113,935	5,124
1974	117,732	3,797
1975	121,799	4,067
1976	126,612	4,813
1977	132,397	5,785
1978	137,478	5,081
10-year Growth 46,356 = 50.9% of year-end '68		
1979	141,638‡	4,160‡

Investment in Total Telephone Plant ($000,000 omitted)

	Year-End Total	Increase
1968	$ 46,092	$ —
1969	50,480	4,388
1970	56,171	5,691
1971	62,049	5,878
1972	68,446	6,397
1973	75,479	7,033
1974	82,683	7,204
1975	89,195	6,512
1976	95,798	6,603
1977	103,576	7,778
1978	110,501	6,925
10-year Growth $64,409 = 139.7% of year-end '68		
1979	120,321‡	9,820‡

Bell System Exchanges

	Year-End Total	Increase/ Decrease
1968	6,762	—
1969	6,764	+ 2
1970	6,769	+ 5
1971	6,761	- 8
1972	6,740	-21
1973	6,734	- 6
1974	6,728	- 6
1975	6,722	- 6
1976	6,713	- 9
1977	6,711	- 2
1978	6,705	- 6
1979	6,703†	- 2†

Operating Revenues ($000,000 omitted)

	Year-End Total	Increase
1968	$14,429	$ —
1969	16,057	1,628
1970	17,369	1,312
1971	18,885	1,516
1972	21,404	2,519
1973	24,089	2,685
1974	26,769	2,680
1975	29,569	2,800
1976	33,493	3,924
1977	37,247	3,754
1978	41,945	4,698
10-year Growth $27,516 = 190.7% of year-end '68		
1979	45,050‡	3,105‡

Operating Company Employes

	Year-End Total	Increase/ Decrease
1968	696,749	—
1969	755,065	+58,316
1970	793,196	+38,131
1971	796,472	+ 3,237
1972	797,202	+ 730
1973	818,168	+20,966
1974	812,139	- 6,029
1975	788,619	-23,520
1976	777,721	-10,898
1977	785,378	+ 7,657
1978	823,159	+37,781
10-year Growth 126,410 = 181.4% of year-end '68		
1979	857,900‡	+34,741‡

*Bell System includes AT&T, its principal telephone subsidiaries, and Bell affiliates (Southern New England Telephone Co. and Cincinnati Bell) whose common stocks are minority-owned by AT&T.
**Includes Bell Service Telephones
†Estimated
‡12 months ended Nov. 30.
Source: AT&T

Table 4 Independent Telephone Company Composite Plant Statistics ($000,000 Omitted)

Buildings

	Year-End Total	Increase
1968	$ 660.5	$—
1969	745	84.5
1970	828.5	83.5
1971	923	94.5
1972	1,028	105
1973	1,117.8	89.8
1974	1,230.8	113
1975	1,344.8	114
1976	1,439.4	94.6
1977	1,523.4	84
1978	1,644.3	120.9

10-year Growth
$983.8=148.9% of year-end '68

Aerial Cable

	Year-End Total	Increase
1968	$1,360	$—
1969	1,460	100
1970	1,590	130
1971	1,747	157
1972	1,875	128
1973	2,010.4	135.4
1974	2,112.5	102.1
1975	2,216.8	104.3
1976	2,359.5	142.7
1977	2,516.4	156.9
1978	2,697.6	181.2

10-year Growth
$1,337.6=98.4% of year-end '68

Central Office Equipment

	Year-End Total	Increase
1968	$2,895	$—
1969	3,350	455
1970	3,797	447
1971	4,365	568
1972	5,017	652
1973	5,662.8	645.8
1974	6,163	500.2
1975	6,763	600
1976	7,542.8	779.8
1977	8,169.8	627
1978	8,963.8	794

10-year Growth
$6,068.8=209.6% of year-end '68

Underground Cable

	Year-End Total	Increase
1968	$ 438.3	$—
1969	483	44.7
1970	540	57.0
1971	608.5	68.5
1972	670	61.5
1973	734.3	64.3
1974	783	48.7
1975	841.1	58.1
1976	910.1	69.0
1977	975.5	65.4
1978	1,081.5	106.0

10-year Growth
$643.2=146.7% of year-end '68

Station Apparatus

	Year-End Total	Increase
1968	$1,018	$—
1969	1,140	122
1970	1,256	116
1971	1,367	111
1972	1,503	136
1973	1,672.9	169.9
1974	1,794.1	121.2
1975	1,905	110.9
1976	2,058.3	153.3
1977	2,275.4	217.1
1978	2,536.4	261.0

10-year Growth
$1,518.4=149.2% of year-end '68

Buried Cable (Plowed In)

	Year-End Total	Increase
1968	$ 592.5	$—
1969	753	160.5
1970	960.5	207.5
1971	1,220	259.5
1972	1,510	290
1973	1,827	317
1974	2,193.2	366.2
1975	2,393.3	200.1
1976	2,851.2	457.9
1977	3,219.4	368.2
1978	3,654.5	435.1

10-year Growth
$3,062.0=516.8% of year-end '68

Large Private Branch Exchanges

	Year-End Total	Increase
1968	$228.3	$—
1969	278	49.7
1970	317.7	39.7
1971	362.6	44.9
1972	406.7	44.1
1973	460.7	54.0
1974	496.1	35.4
1975	531.3	35.2
1976	598.5	67.2
1977	660.3	61.8
1978	726.2	65.9

10-year Growth
$497.9=218% of year-end '68

Underground Conduit

	Year-End Total	Increase
1968	$241.7	$—
1969	278	36.3
1970	320	42
1971	365	45
1972	406.3	41.3
1973	457.4	51.1
1974	494.1	36.7
1975	518.6	24.5
1976	566.5	47.9
1977	606.8	40.3
1978	664.5	57.7

10-year Growth
$422.8=174.9% of year-end '68

Vehicles, Other Work Equipment

	Year-End Total	Increase
1968	$195.1	$—
1969	221	25.9
1970	248	27
1971	281.9	33.9
1972	302	20.1
1973	338.1	36.1
1974	357	18.9
1975	365.1	8.1
1976	404.4	39.3
1977	459.9	55.5
1978	550.6	90.7

10-year Growth
$355.5=182.2% of year-end '68

Source: USITA (Extrapolated by TELEPHONY to 100% of Independent companies.)

figure of 1500. Major mergers completed during 1979 included three of the top 25 Independents. The biggest of these—Winter Park (Fla.) Telephone Co., with 165,900 stations—was acquired by United Telecommunications, Inc., Kansas City, Mo., the second largest Independent telephone holding company in the country. The other two top-25 acquisitions both became part of Mid-Continent Telephone Corp., Hudson, Ohio, fifth largest Independent holding company. Those acquisitions were Telephone Utilities of Pennsylvania, Export, Pa., with 99,400 telephones; and Newark (Ohio) Telephone Co., with 52,200 phones. Twenty-four other mergers, in addition to these three, took place during the year.

Of the 22 Independent telcos reporting to us for this survey (who represent 87.9% of the total Independent industry), 17 report that they spent more on construction in 1979 than in 1978. Four companies spent less, and one spent the same amount both years. Looking ahead to 1980, all but four of the 22 say their expenditures will increase this year. (See Table 6 on page 46.)

All of the top five companies of the 22 report increases in construction spending in 1979, with Mid-Continent spending 26% more than in '78, Continental 20.5%, United 20%, General Telephone 11.1% and Central .6%. Among the four reporting lower spending for 1979 decreases ranged from 25.7% to 8%. The highest increase reported among all 22 was 62% by Universal Telephone, Milwaukee.

Budgets this year are up for 18 of the 22 companies, with increases ranging from 3.4% to 58.8%. Decreases among the four which are budgeting less than in '79 range from 3.4% to 23.4%. All of the top five companies expect increased construction spending for the year: General up 10%, United up 4.3%, Continental up 16.7%, Central up 11.8% and Mid-Continent up 23.4%.

For '81, 11 of the 22 project budget increases above this year's, with those increases ranging from less than 1% to a high of 28.8%. Two companies would not venture a prediction for 1981; three companies say they'll spend the same next year as this, and six say their

spending will go down. Among the top companies, General and United predict increased construction spending of 9% and 6% respectively for 1981 over 1980. Continental projects a decrease of 2%.

For the Bell operating companies—always more chary of providing advance spending estimates than the Independents—the construction figures are shown in Table 7 on page 46. All Bell operating units spent more on construction in 1979 than in '78, and all but one have budgeted more for '80 than '79. Indiana Bell expects to spend the same this year as last. The total for 1980 for the Bell companies and affiliates is $17 billion, up $1.1 billion over 1979. (See Table 7.)

Changes in the industry's plant makeup over the past ten years are shown in Table 4 for the Independents and Table 5 for the Bell System.

The Independent statistics trace growth in these categories: buildings, underground cable, PBXs, aerial cable, station apparatus, underground conduit, central office equipment, buried cable and vehicles. Highest percentage growth over the 10 years 1968-78 was in buried (plowed-in) cable—up 516.8%. Other high-growth categories during the ten years: PBXs, up 218%; and central office equipment, up 209.6%. There has been a fall-off in percentage of growth in all categories in the 1968-78 period compared to 1967-77 except for station apparatus and for vehicles.

Buried cable (plowed-in) also showed the highest 10-year percentage growth in the Bell System (318.9%). Other high-growth categories were: underground conduit, up 202.4% in the ten years; and vehicles and other work equipment, up 187.7%.

Looking at the top investment categories of the two segments of the industry indicates some of the historic and continuing differences in their types of operation. Both Bell and Independents have their greatest investment in central office equipment. But number two category for the Independents is buried cable, and number three is still aerial cable. Number two investment category for Bell is station equipment, and number three is buildings. □

(Tables 6 and 7 appear on page 46 of this issue.—Ed.)

Table 5 Bell System Composite Plant Statistics ($000,000 Omitted) (Source AT&T)

Buildings

	Year-End Total	Increase
1968	$4,106	$—
1969	4,441	335
1970	4,917	476
1971	5,507	590
1972	6,157	650
1973	6,913	756
1974	7,569	656
1975	8,266	697
1976	8,950	684
1977	9,553	603
1978	10,080	527

10-year Growth
$5,974=145.5% of year-end '68

Large Private Branch Exchanges

	Year-End Total	Increase
1968	$1,781	$—
1969	2,008	227
1970	2,237	229
1971	2,442	205
1972	2,645	203
1973	2,842	197
1974	3,030	188
1975	3,167	137
1976	3,230	63
1977	3,256	26
1978	3,300	44

10-year Growth
$1,519=85.3% of year-end '68

Underground Cable

	Year-End Total	Increase
1968	$2,933	$—
1969	3,191	258
1970	3,536	345
1971	3,967	431
1972	4,395	428
1973	4,874	479
1974	5,419	545
1975	5,864	445
1976	6,262	398
1977	6,760	498
1978	7,393	633

10-year Growth
$4,460=152% of year-end '68

Aerial Cable

	Year-End Total	Increase
1968	$4,438	$—
1969	4,683	245
1970	4,944	261
1971	5,206	262
1972	5,520	314
1973	5,894	374
1974	6,283	389
1975	6,673	390
1976	7,126	453
1977	7,659	533
1978	8,258	599

10-year Growth
$3,820=86% of year-end '68

Station Apparatus

	Year-End Total	Increase
1968	$3,867	$—
1969	4,293	426
1970	4,641	348
1971	4,879	238
1972	5,303	424
1973	5,753	450
1974	6,125	372
1975	6,636	511
1976	7,238	602
1977	8,039	801
1978	9,026	987

10-year Growth
$5,519=133.4% of year-end '68

Buried Cable (Plowed In)

	Year-End Total	Increase
1968	$2,249	$—
1969	2,696	447
1970	3,163	467
1971	3,721	558
1972	4,269	548
1973	4,930	661
1974	5,757	827
1975	6,593	836
1976	7,357	764
1977	8,283	926
1978	9,421	1,138

10-year Growth
$7,172=318.9% of year-end '68

Central Office Equipment

	Year-End Total	Increase
1968	$16,242	$—
1969	17,805	1,563
1970	19,628	1,823
1971	22,020	2,392
1972	24,692	2,672
1973	27,541	2,849
1974	30,356	2,815
1975	33,098	2,742
1976	35,351	2,253
1977	37	2,363
1978	40.	2,689

10-year Growth
$24,161=148.8% of year-end '68

Vehicles & Other Work Equipment

	Year-End Total	Increase
1968	$ 538	$—
1969	596	58
1970	696	100
1971	773	77
1972	862	89
1973	971	109
1974	1,069	98
1975	1,122	53
1976	1,225	103
1977	1,365	140
1978	1,548	183

10-year Growth
$1,010=187.7% of year-end '68

Underground Conduit

	Year-End Total	Increase
1968	$1,716	$—
1969	1,891	175
1970	2,165	274
1971	2,459	294
1972	2,772	313
1973	3,162	396
1974	3,635	467
1975	3,975	340
1976	4,266	291
1977	4,646	380
1978	5,189	543

10-year Growth
$3,473=202.4% of year-end '68

Total Station Equipment

	Year-End Total	Increase
1968	$9,386	$—
1969	10,418	1,032
1970	11,376	958
1971	12,245	869
1972	13,344	1,099
1973	14,501	1,157
1974	15,578	1,077
1975	16,769	1,191
1976	18,117	1,348
1977	19,835	1,718
1978	21,974	2,139

10-year Growth
$12,588=134.1% of year-end '68